Regional dimensions of environmental security

Donald Kennedy

A group of us at Stanford, working with the Carnegie Commission on the Prevention of Deadly Conflict, is trying to develop predictive measures for identifying potential loci of environment-related regional conflict. As a newcomer to this business, I want to record first our great respect for the work of others (in particular, the Toronto–Wilson–American Association for the Advancement of Science axis) who have developed such valuable case studies and historical data on the relationship between environmental quality and regional security problems. Their studies have helped us immeasurably in forming our own approach.

I shall pass quickly over the overworked question of whether environmental security is merely a cover to try to promote a green agenda into the domain of high politics. No matter how you slice it, environment will matter. The world population in 2050—the year in which my current undergraduates will be the age Bob Dole is now—cannot be less than 80% larger than the present one, and may be twice as large. This horde of people, most of them in what we now call the developing world, will be trying to extract more per capita than their predecessors from a set of finite, often common-property, resources. They will be doing this against a background of relentless change: in climate, in land cover, and in the biotic environment. At the same time, they will be contending with old hatreds: religious, ethnic, and class. If you don't believe that scarcity and environmental deterioration will add combustible material to these historic sources of tension, nothing that follows is likely to interest you.

The approach I will discuss is fairly simple-minded, and very much a work in progress. The idea is to construct, from existing data bases, maps of the world that display the distribution of various important environmental and population parameters. Similar maps are created to reflect traditional enmities, histories of conflict, and zones of political instability. When these maps are laid over one another, in a kind of reverse gap analysis, the regions of overlap should be ones in which there is a significant prospect for future security problems. The exercise is not so very different from the one we perform in our heads when, for example, we recognize that the combination of historic tensions and acute developing water shortages makes the Middle East a hot spot. The difference is that in other regions and for more distant futures, the coalition of tension-generating variables may be much more complex: age-distribution and fertility rates of local populations, liability to sea-level rise due to global climate change, deforestation, vulnerability to epidemic disease, to mention only a few.

Background

The present status of world conflict tells us something about what to look for. Of 30 wars currently under way (a war is defined as a violent conflict entailing over 1000 battle deaths per year) not a single one is a contest between nation-states. As the current difficul-

ties in Bosnia and in Middle East emphasize, ethnic differences and traditional enmities have little relationship to national boundaries. The Caucasus, with its welter of newly independent states and its patchwork of ethnic and religious affinities, is another example. Both also illustrate another feature: that the distribution of common-property resources and the occurrence of environmental problems are also unrelated to political divisions.

The distribution of fresh water is a particularly clear example. Over 70% of the world's habitable land surface lies in multinational river basins. In some cases (the Colorado, and more recently the Ganges) negotiations have yielded allocation agreements between upstream and downstream states—however "fair" these may appear years after they have been signed. But in many others there are no agreements at all. Upstream states in the past have done, or threatened to do, all of the following to downstream states: pollute the water, take it for interbasin transfers, impound it and limit flow, impound it and then release it deliberately to provoke downstream flooding.

Figure 14-1 shows a map of the rivers of Southern Africa, with the national

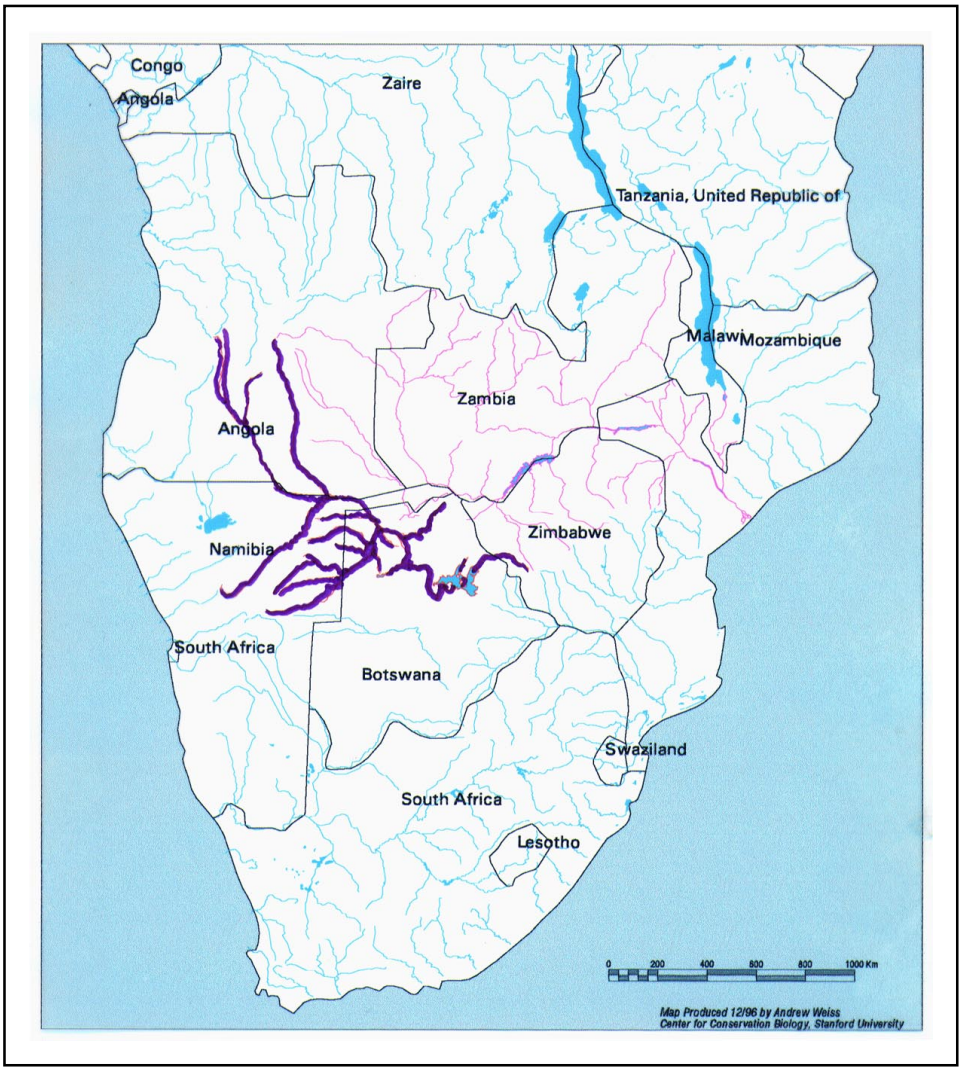

Figure 14-1. Okavanga and Zambesi River systems in southern Africa.

boundaries indicated. Note that the Zambezi is shared by eight nations—all of whom fear that a ninth nonriparian nation, South Africa, has designs on it for interbasin transfers. In the highlands of land-locked Lesotho, Peter Gleick reports, plans for an interbasin transfer to the metropolitan north of South Africa has produced angry resistance from riparians on the Orange River, far to the east. Five South African rivers flow through Kruger National Park before supplying southern Mozambique with much of its fresh water. The Okavanga is shared by Angola; Namibia, which wants to divert some of it; and Botswana, where it ends in a "delta" that is the country's main tourist attraction. In NONE of these cases is there any international agreement respecting allocation.

That is barely a start on one problem, on one continent. I hope it illustrates both the complexity of the challenge, and its seriousness. Now I turn to some of the important variables of population and environmental quality.

Population

It stands to reason, I think, that the numbers of people in an area, the rate at which the numbers are expanding, and the other characteristics of the population will be important to future stability. Figure 14-2 is a fairly standard map of population

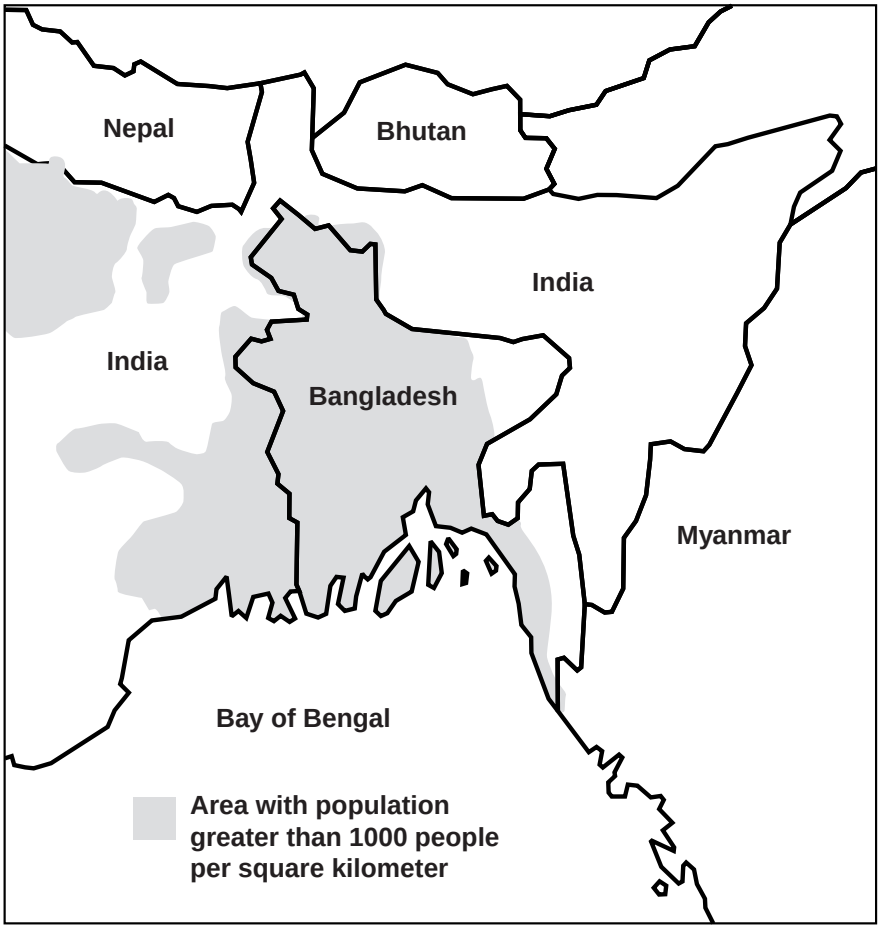

Figure 14-2. Population distribution in the region of the Brahmaputra-Ganges delta.

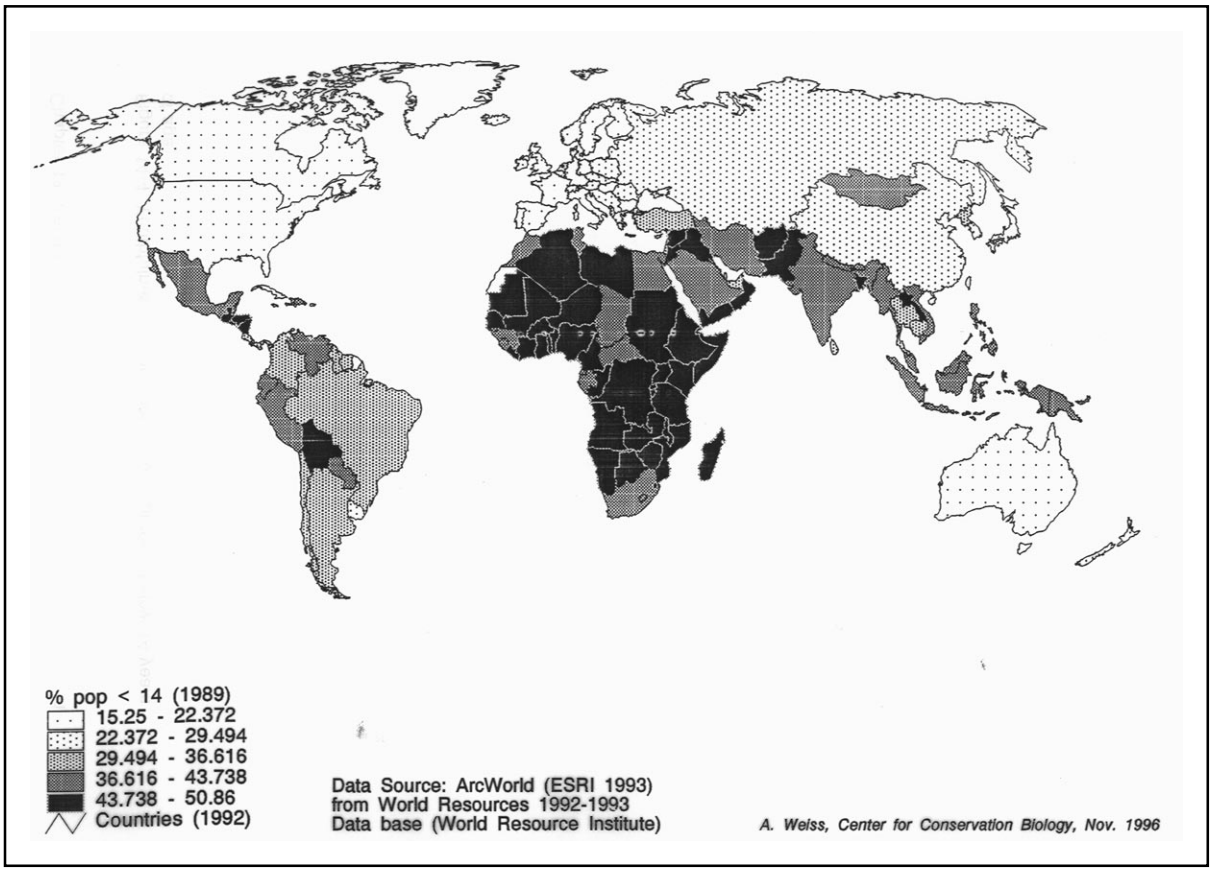

Figure 14-3. Youthfulness of world populations: percent below 14 years of age.

density, done in cells of about 100 square kilometers (km^2) for the Ganges-Brahmaputra delta. Developing nations like Bangladesh that have rapidly expanding populations, often with depleting resources, may be inherently unstable—and likely to confirm Cairncross' prophecy that "teenage populations are unlikely to be easy to negotiate with." Figure 14-3 displays the world in terms of what proportion of each national population is in the age range 0–14 years; youthfulness is not only a proxy for potential instability, but for rapid future growth due to "population momentum."

To specify the size, age, structure, and growth rate of a population and stop there is to leave out something obvious but important. The youthful nations in Figure 14-3 are also poor nations, with rapidly increasing needs from their environments that will accelerate the degradation of the latter.

Land cover change

A measure of that demand can be gotten from data on changes in the use to which land is being put, and the kind of vegetation that occurs on it. Indicators of the rates of land use and land cover change are not easy to obtain and to interpret. Satellite images are very useful, but often fail to indicate the finer structure of cover change; ground measurements are spotty, and thus even estimates of forest loss are subject to some variation.

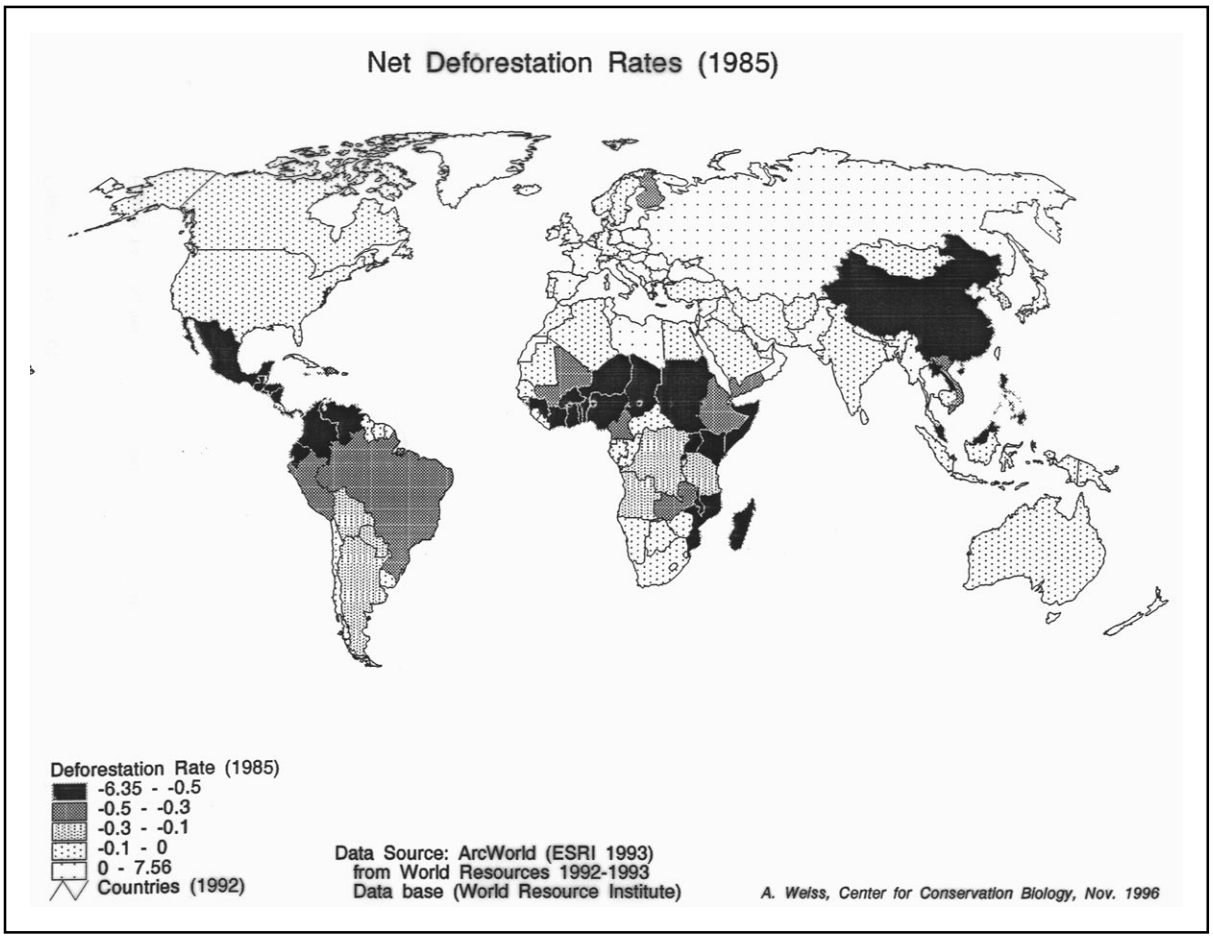

Figure 14-4. National net deforestation rates in 1985.

However, there is general agreement that the rates of loss of "closed forest" range between 0.5 and 1.5% per year. Figure 14-4 shows such estimates by nation for the year 1985 and demonstrates the concentration of high-loss nations in the developing world. From a broad environmental perspective, deforestation in the biologically rich nations of the tropics lower latitudes poses a potentially serious problem: the loss of biological diversity and of "ecosystem services." But in the more open dryland forests of other parts of the developing world, less dramatic loss of forests means that many of the world's two billion people who gather firewood for heating and cooking will have to travel farther and compete with others for what is left.

An equally meaningful geographic land variable would be soil quality. There is general agreement that in many parts of the world—particularly in the tropics, where soils are readily depleted because most nutrients are held at the surface, in living tissue—the quality and depth of soil has been significantly reduced. Beyond general estimates, it is difficult to obtain a regional picture of this important change in environmental quality.

The three variables critical to the support of poor rural people in the Third World are good water, good soil, and adequate wood. If they are lacking, troublesome consequences are likely to follow: the value of children as household assets may increase,

stimulating accelerating population growth and launching a "vicious cycle" of environmental destruction; or mass movements of desperate people may generate conflict.

Climate change

Although there is general agreement that continued population growth and increasing per-capita energy demand will continue to add CO_2 and other "greenhouse gases" to the atmosphere, the degree of global warming is subject to debate because of the effects of aerosols, the feedback influence of increased cloud cover, and other uncertainties. A consensus view would put the average change due to a doubling of atmospheric CO_2—scheduled for late in the 21st century—at somewhere between 1 and 4 degrees Celsius.

Associated with this change will be a rise in average sea level (due to glacial melting and the thermal expansion of water) of a few tens of centimeters to one meter, and a possible increase in the intensity of violent storms. Global weather patterns, including monsoons, are notoriously sensitive, and their impacts on human welfare can be potent: for example, El Niño Southern Oscillation (ENSO) events can be correlated with maize yields in Africa and changes in precipitation in Central America, with significant outcomes for human health and welfare.

The populations affected by a rise in the average sea-level is shown in Table 14-1. Recalling Figure 14-2, which showed the high population density in the very low lying regions of the Brahmaputra-Ganges River deltas, suggests a likely location for massive population movements. Since this is also a region where monsoons regularly cause disastrous flooding, the influence of static sea-level rise is likely to be amplified by episodes of violent storms.

Climate change will also produce shifts in patterns of agricultural productivity for other reasons: CO_2 fertilization effects, increased temperature, altered patterns of precipitation, and alterations in growing season. The impacts of these changes on human populations, some of which are already apparent, and the resulting threats to security, are simply unpredictable at this point. But in general it is likely that the effects on agriculture in the poor countries, especially in the tropics, will be most severe—whereas the high-yield grain producing areas at high latitudes will be more able to adapt, and might even benefit. Thus

Table 14-1. Potential for population displacement by sea level rise.

Sea Level Rise	Population	Cumulative Population	Area affected (x 100 sq.km)	Cumulative Area
0 m	3,819,037	3,819,037	60	60
1 m	4,184,583	8,003,620	95	155
2 m	9,131,994	17,135,614	110	265
3 m	9,528,970	26,664,584	148	413
4 m	11,239,534	37,904,118	137	550
5 m	13,177,408	51,081,526	162	712

the likely impact of all climate-change prospects will enhance the already great disparity between the developed and the developing world.

Other possibly important changes include the effect of climate and population movements on infectious disease—both the pathogens themselves and their vectors. Traditional pathogens (malaria, cholera) are already shown to be influenced by climate change, and as people move into new, previously uninhabited areas, new infectious agents are likely to "emerge" (e.g. HIV, Marburg, Ebola).

Spatial relationships

Variables like environmental quality, population density, and income or other welfare indicators become more meaningful when their spatial configurations are clear. If, for example, rapidly growing populations of increasingly poor people are juxtaposed with affluent populations that have plenty of space and a more productive environment, there will be strong incentives for the former to move in the direction of the latter.

Rapidly industrializing nations often produce adverse transboundary effects on neighboring states, generating opportunities for interstate conflict. The development of a coal-powered industrial economy in China, for example, portends significant acid-rain deposition in the Korean peninsula and Japan. Pollution of inland or semi-enclosed seas, or over exploitation of common-property resources in them, could also lead to regional conflict.

Thus in trying to analyze environment/security relationships, border arrangements and regional differences in any of the relevant parameters are important. Under what circumstances might such tensions lead to conflict? I turn now to the important issue of political stability and conflict history.

Political variables

So far, I have been discussing the size and growth of human populations and the changes they have been exerting on the environment. Powerful forces are at work to enhance the probability of conflict: more people, fewer local resources, and degradation of those that remain.

But, of course, conflict requires more than misery. Plainly, peoples that have a history of fighting with one another are likely to do so again under the right circumstances. Where stable institutions are lacking and where religious or ethnic antipathy is high, the conditions are hospitable to trouble.

It is not easy to display these propensities in geographic form, nor is it immediately apparent what parameters one should choose. The plausible indicators of internal comity are many: they include a history of stable government, whether the nation is a democracy with a tradition of respect for human rights, the presence of strong civic associations, and literacy. Yet juxtaposed nations or peoples might rank reasonably well on some of these, but fight with one another because of traditional antipathies or resource needs.

We are trying to think through ways to represent these elements; at this time, the most tractable seems to involve the collection of expert opinion. Local and regional ranking for stability of political institutions, conflict history, and some indicator of

ethnic or religious hostility should provide a way of integrating the geography of environmental and population stress with the sociopolitical variables.

Conclusion

Obviously this is a work in progress, and it entails a great deal of uncertainty. There is room for argument about almost every relationship and every parameter we have used. On the other hand, environmental pressures are mounting rapidly, and the prospect for unanticipated and tragic episodes mandates some boldness in trying to define an uncertain future.

It is important to add that the regional approach ignores some problems that may arise at a more global scale, as the result of major changes in climate or resource distribution. If it became obvious to a set of industrial nations that unchecked development elsewhere posed a major threat to the global environment, might they be tempted to halt it through military intervention? If it became obvious to a set of poor nations that the resource disparity facing them with respect to the industrial countries was unacceptable, might they be tempted to redress it through terrorism?

I have a personal concern that is less apocalyptic than either of the above—but is, in some ways, as troublesome. As the poor nations become poorer and their environments more impoverished, my fear is that local conflict will become irruptive—so much so that the best good will in the industrialized world will be unable to cope with it. The consequence will not only be a multiple disaster for the peoples in conflict; for the helpless observers in the rich nations it will be a relentlessly growing moral crisis. As we watch the collapse we will find ourselves caught between the impulse to give what we have and the desperate knowledge that it will not be enough. Survivor's guilt is not easy to live with. To avoid it, we simply must try to think this thing through, using whatever intelligence and imagination we can bring to the task.